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cavities of *Lycopodium* and the parichnos of fossil genera." In some cases the sporophylls are provided with more or less conspicuous dorsal outgrowths, which have been noted heretofore only in a casual way, but not definitely described. Four types of sporophyll are described: (1) with well developed dorsal flap extending freely downward and protecting the young sporangium immediately below it (as *S. rupestris*); (2) with no dorsal flap, the sporophyll being flat and the sporangium exposed (as *S. spinosa*); (3) with a well developed dorsal projection which is not free but decurrent (as *S. helvetica*); and (4) a series in which the dorsal outgrowth is gradually reduced and lost, each sporophyll more and more completely infolding the sporangium below (as *S. flabellata* to *S. apus*).—J. M. C.

Morphology of Callitris.—SAXTON,[13] in continuing his studies of gymnosperms, has given an account of *Callitris*, an Australasian genus of about a dozen species. The one chiefly studied was *C. verrucosa*, but the results doubtless apply to the genus as a whole, since the species are very closely allied. The sporophylls are in alternating whorls of three, each microsporophyll bearing three sporangia, and each of the upper megasporophylls bearing about 15 ovules, the six sporophylls of the ovulate strobilus producing about 60 ovules. The cells of the mature female gametophyte are all binucleate or multinucleate. The archegonia occur in a single group of about 20, never at the apex of the gametophyte, but along the inner side of the pollen tube near its apex. If two pollen tubes are present, two such groups are organized. The proembryo completely fills the archegonium, the arrangement of cells being variable. More than one embryo is formed from a proembryo, and the first two walls are longitudinal, the mature embryo being dicotyledonous. The claim is well substantiated that *Callitris* and *Widdringtonia* are two distinct genera, but that they should constitute a separate tribe (Callitrineae) coordinate with Cupressineae is not so clear.—J. M. C.

Structure of Mitrospermum.—Mrs. ARBER[14] has investigated the structure of the platyspermous seed described by WILLIAMSON in 1877 as *Cardiocarpon compressum*, and occurring in the British Lower Coal-measures. The outer fleshy (forming the wing-like extension), stony, and inner fleshy layers are recognized and described. Two opposite vascular strands arise from the expanded bundle beneath the nucellus and traverse the outer fleshy layer in the principal plane of the seed, probably continuing almost the whole length of the seed. The nucellus seems to have been entirely free from the integument, and in one seed a tissue within the embryo sac was observed, consisting of "irregular roundish cells," which of course represent the female gametophyte. The conclusion is reached that the seed deserves to be removed from *Cardiocarpon*, chiefly on account of its vascular structure, and therefore a new genus *Mitrospermum* is proposed. Whether the seed belongs to *Cordaites* or not was not determined, for the platysperm character can no longer be used as an indication of that group. Sections of unattached seeds must continue to be made, but there is far greater need of sections of attached seeds, for these will probably solve the puzzling embryo situation attributed to paleozoic seeds.—J. M. C.

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[13] SAXTON, W. T., Contributions to the life history of *Callitris*. Annals of Botany **24**:557–569. *pls. 45, 46.* 1910.

[14] ARBER, AGNES, On the structure of the paleozoic seed *Mitrospermum compressum* (Will.). Annals of Botany **24**:491–509. *pls. 37–39. figs. 2.* 1910.

Phototropism.—NORDHAUSEN[15] offers more evidence against the lens theory of phototropic perception. He finds that leaves of *Begonia* with killed epidermis assume the normal light position, the palisade cells being the perceptive organs. He says that "the epidermis as well as its papillose character are not necessary for light perception." He finds a great difference between the sensitiveness of the two halves of the leaves of *Tropaeolum*, which renders them unsuitable for comparing the effect of light on the wet and dry halves. This plant and method have furnished HABERLANDT with his best evidences for the lens theory. After offering this significant evidence against the theory, he states that HABERLANDT'S reply to his former criticism has not rendered that criticism any less applicable. He also holds that the evidence offered in HABERLANDT'S later papers is not of a sufficiently critical nature to give the theory any support.—WILLIAM CROCKER.

Carbon dioxid as a fertilizer.—A Berlin company has placed a product on the market known as "Germanol," which consists of an earthy mixture containing about 18 per cent calcinated soda. The company attributes the virtue of this mixture to an increased porosity of the soil following an increase in the proportion of carbon dioxid. MITSCHERLICH,[16] however, is of the opinion that if such a mixture has any value it must be attributed to the action of the carbon dioxid in increasing the solubility of various difficultly soluble soil substances. His comprehensive tests show that increasing the carbon dioxid content of the soil does not result in an increase of plant product; that there is always sufficient carbon dioxid in the soil to render mineral food available; that an increase in the carbon dioxid in the soil does increase the solubility of difficultly soluble substances, but that such increase is superfluous so far as any advantage to the plant is concerned.—RAYMOND H. POND.

Rhizophore of Selaginella.—WORSDELL[17] has used an investigation of the rhizophore of *Selaginella* as the basis of a discussion of the ultimate morpho-

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[15] NORDHAUSEN, M., Ueber die Perzeption der Lichtsichtung durch die Blattspreite. Zeitschr. Bot. **2**:465–506. 1910.

[16] MITSCHERLICH, EILHARD ALFRED, Ein Beitrag zur Kohlensäuredüngung. Landwirtsch. Jahrb. **39**:157–166. 1910.

[17] WORSDELL, W. C., The rhizophore of *Selaginella*. New Phytol. **9**:242–253. *figs. 2.* 1910.